WHAT IS CLAIMED IS:

1. An apparatus for estimating a frequency offset to compensate for the frequency offset of the I and Q channel signals, in a receiving apparatus of a mobile communication system, said receiving apparatus for receiving a signal containing training symbols of a predetermined pattern inserted in a data symbol sequence, downconverting the received signal by a predetermined carrier frequency, and outputting in-phase (I channel) and quadrature-phase (Q channel) signals, comprising:

an adder for adding I and Q channel training signals and outputting a sum channel signal containing one of a cosine component or a sine component, the I and Q channel training signals being obtained by downconverting the training symbols;

a subtractor for subtracting the Q channel training signal from the I channel training signal and outputting a difference channel signal containing one of the sine component or the cosine component in correspondence with the sum channel signal; and

a frequency offset estimator for receiving a first sum channel signal and a first difference channel signals at a first point in time, receiving a second sum channel signal and a second difference channel signal at a second point in time, calculating a first phase value using the first sum channel signal and the first difference channel signal, calculating a second phase value using the second sum channel signal and the second difference channel signal, and estimating the frequency offset by determining the slope of a second-order line derived from the first and second phase values.

2. The apparatus of claim 1, wherein if the training symbols are equal, the adder outputs a sum channel signal containing only the sine component and the subtractor outputs a difference channel signal containing only the cosine component.

3. The apparatus of claim 2, wherein the frequency offset estimator calculates the first and second phase values using first and second tangent components, the first tangent component expressed as a fraction having the first sum channel signal as a denominator and the first difference channel signal as a numerator, and the second tangent component expressed as a fraction having the second sum channel signal as a denominator and the second difference channel signal as a numerator.

4. The apparatus of claim 1, wherein if the training symbols are different, the adder outputs a sum channel signal containing only the cosine component and the subtractor outputs a difference channel signal containing only the sine component.

5. The apparatus of claim 4, wherein the frequency offset estimator calculates the first and second phase values using first and second tangent components, the first tangent component expressed as a fraction having the first difference channel signal as a denominator and the first sum channel signal as a numerator and the second tangent component expressed as a fraction having the second difference channel signal as a denominator and the second sum channel signal as a numerator.

6. The apparatus of claim 1, further comprising a frequency offset compensator for generating a first signal by subtracting the product of the Q channel signal and a cosine component of the frequency offset from the product of the I channel signal and a sine component of the frequency offset, the I and Q channel signals generated by downconverting the data symbol sequence, and generating a second signal by adding the product of the I channel signal and the cosine component of the frequency offset to the product of the Q channel signal and the sine component of the frequency offset.

7. The apparatus of claim 1, further comprising a memory for storing the frequency offset.

8. A method of estimating a frequency offset to compensate for the frequency offset of the I and Q channel signals, in a receiving apparatus of a mobile communication system, said recurring apparatus for receiving a signal containing training symbols of a predetermined pattern inserted in a data symbol sequence, downconverting the received signal by a predetermined carrier frequency, and outputting in-phase (I channel) and quadrature-phase (Q channel) signals, comprising the steps of:

adding I and Q channel training signals and outputting a sum channel signal containing one of a cosine component or a sine component, the I and Q channel training signals being obtained by downconverting the training symbols;

subtracting the Q channel training signal from the I channel training signal and outputting a difference channel signal containing one of the sine component or the cosine component in correspondence with the sum channel signal; and

receiving a first sum channel signals and a first difference channel signals at a first point in time, receiving a second sum channel signal and a second difference channel signal if a second point in time, calculating a first phase value using the first sum channel signal and the first difference channel signal calculating a second phase value using the second sum channel signal and the second difference channel signal, and estimating the frequency offset by determining the slope of a second-order line derived from the first and second phase values.

9. The method of claim 8, wherein if the training symbols are equal, the sum channel signal contains only the sine component and the difference channel signal contains only the cosine component.

10. The method of claim 9, wherein the first and second phase values are calculated using first and second tangent components, the first tangent component expressed as a fraction having the first sum channel signal as a denominator and the first difference channel signal as a numerator, and the second tangent component expressed as a fraction with the second sum channel signal as a denominator and the second difference channel signal as a numerator.

11. The method of claim 8, wherein if the training symbols are different, the sum channel signal contains only the cosine component and the difference channel signal contains only the sine component.

12. The method of claim 11, wherein the first and second phase values are calculated using first and second tangent components, the first tangent component expressed as a fraction having the first difference channel signal as a denominator and the first sum channel signal as a numerator and the second tangent component expressed as a fraction having the second difference channel signal as a denominator and the second sum channel signal as a numerator.

13. The method of claim 8, further comprising the steps of:

generating a first signal by subtracting the product of the Q channel signal and a cosine component of the frequency offset from the product of the I channel signal and a sine component of the frequency offset, the I and Q channel signals generated by downconverting the data symbol sequence; and

generating a second signal by adding the product of the I channel signal and the cosine component of the frequency offset to the product of the Q channel signal and the sine component of the frequency offset.

14. The method of claim 8, further comprising the step of storing the frequency offset in a memory.

15. An apparatus for estimating a frequency offset to compensate for the frequency offset of the I and Q channel signals, in a receiving apparatus of a mobile communication system, said receiving apparatus for receiving a data symbol sequence, downconverting the received data symbol sequence by a predetermined carrier frequency, and outputting in-phase (I channel) and quadrature-phase (Q channel) signals, comprising:

a symbol detector for outputting an update request command when demodulated symbols of a predetermined pattern are detected among demodulated symbols of the I and Q channel signals;

an adder for adding the I and Q channel signals and outputting a sum channel signal containing one of a cosine component or a sine component;

a subtractor for subtracting the Q channel signal from the I channel signal and outputting a difference channel signal containing one of the sine component or the cosine component in correspondence with the sum channel signal; and

a frequency offset estimator for receiving a first second sum channel signal and a first difference channel signals at a first point time, receiving a second sum channel signal and a second difference channel signal at a second point in time, calculating a first phase value using the first sum channel signal and the first difference channel signal, calculating a second phase value using the second sum channel signal and the second difference channel signal, estimating the frequency offset by determining the slope of a second-order line derived from the first and second phase values, and outputting the frequency offset in response to the update request command.

16. The apparatus of claim 15, wherein the predetermined pattern is one of (1,1), (1,-1), (-1,1) and (-1,-1).

17. The apparatus of claim 16, wherein if the predetermined pattern

is (1,1) or (-1,-1), the adder outputs a sum channel signal containing only the sine component and the subtractor outputs a difference channel signal containing only the cosine component.

18. The apparatus of claim 16, wherein the frequency offset estimator calculates the first and second phase values using first and second tangent components, the first tangent component expressed as a fraction having the first sum channel signal as a numerator, and the first difference channel signal as a nominator and the second tangent component expressed as a fraction having the second sum channel signal as a denominator and the second difference channel signal as a numerator.

19. The apparatus of claim 16, wherein if the predetermined pattern is (1,-1) or (-1,1), the adder outputs a sum channel signal containing only the cosine component and the subtractor outputs a difference channel signal containing only the sine component.

20. The apparatus of claim 19, wherein the frequency offset estimator calculates the first and second phase values using first and second tangent components, the first tangent component expressed as a fraction having the first difference channel signal as a denominator and the first sum channel signal as a numerator, and the second tangent component expressed as a fraction having the second difference channel signal as a denominator and the second sum channel signal as a numerator.

21. The apparatus of claim 15, further comprising a frequency offset compensator for generating a first signal by subtracting the product of the Q channel signal and a cosine component of the frequency offset from the product of the I channel signal and a sine component of the frequency offset, and generating a second signal by adding the product of the I channel signal and the

cosine component of the frequency offset to the product of the Q channel signal and the sine component of the frequency offset.

22. The apparatus of claim 15, further comprising a memory for storing the frequency offset.

23. A method of estimating a frequency offset to compensate for the frequency offset of the I and Q channel signals, in a receiving apparatus of a mobile communication system, said receiving apparatus for receiving a data symbol sequence, downconverting the received data symbol sequence by a predetermined carrier frequency, and outputting in-phase (I channel) and quadrature-phase (Q channel) signals, comprising the steps of:

outputting an update request command when demodulated symbols of a predetermined pattern are detected among demodulated symbols of the I and Q channel signals;

adding the I and Q channel signals and outputting a sum channel signal containing one of a cosine component or a sine component;

subtracting the Q channel signal from the I channel signal and outputting a difference channel signal containing one of the sine component or the cosine component in correspondence with the sum channel signal; and

receiving a first sum channel signals and a first difference channel signals at a first point in time, receiving a second sum channel signal and a second difference channel signal at a second point in time, calculating a first phase value using the first sum channel signal and the first difference channel signal, calculating a second phase value using the second sum channel signal and the second difference channel signal, estimating the frequency offset by determining the slope of a second-order line derived from the first and second phase values, and outputting the frequency offset in response to the update request command.

24. The method of claim 23, wherein the predetermined pattern is one of (1,1), (1,-1), (-1,1) and (-1,-1).

25. The method of claim 24, wherein if the predetermined pattern is (1,1) or (-1,-1), the sum channel signal contains only the sine component and the difference channel signal contains only the cosine component.

26. The method of claim 25, wherein the first and second phase values are calculated using first and second tangent components, the first tangent component expressed as a fraction having the first sum channel signal as a denominator and the first difference channel signal as a numerator, and the second tangent component expressed as a fraction having the second sum channel signal as a denominator and the second difference channel signal as a numerator.

27. The method of claim 24, wherein if the predetermined pattern is (1,-1) or (-1,1), the sum channel signal contains only the cosine component and the difference channel signal contains only the sine component.

28. The method of claim 27, wherein the first and second phase values are calculated using first and second tangent components, the first tangent component expressed as a fraction having the first difference channel signal as a denominator and the first sum channel signal as a numerator ,and the second tangent component expressed as a fraction having the second difference channel signal as a denominator and the second sum channel signal as a numerator.

29. The method of claim 23, further comprising the steps of:

generating a first signal by subtracting the product of the Q channel signal and a cosine component of the frequency offset from the product of the I channel signal and a sine component of the frequency offset; and

generating a second signal by adding the product of the I channel signal and the cosine component of the frequency offset to the product of the Q channel signal and the sine component of the frequency offset.

30. The method of claim 23, further comprising the step of storing the frequency offset in a memory.